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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/076,022	02/14/2002	John Thomson	073169/0293210	7938

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EXAMINER
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TRAN, KHANH C

ART UNIT	PAPER NUMBER
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2631

DATE MAILED: 11/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/076,022	THOMSON ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Khanh Tran	2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 31 August 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-63 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 37-59 is/are allowed.
- 6) ☒ Claim(s) 1,2,13,14,25-27 and 60-63 is/are rejected.
- 7) ☒ Claim(s) 3-12,15-24 and 28-36 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. The Amendment filed on 08/31/2005 has been entered. Claims 1-63 are pending in this Office action.

### ***Response to Arguments***

2. The Declaration Under CFR 1.131 has been entered and accepted.

3. Applicant's arguments, see the Declaration Under CFR 1.131, filed on 08/31/2005, with respect to the rejection(s) of claim(s) 1-5,11,13-17,23,25-30,36-38,52,53 and 59-63 under 35 U.S.C 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Peeters et al. U.S. Patent 6,628,738 B1 and Gupta U.S. Patent 5,818,872.

4. The objection of claims 13 and 25 has been withdrawn after claims 13 and 25 were corrected for the informalities.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-2, 60-63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peeters et al. U.S. Patent 6,628,738 B1.

Regarding claim 1, Peeters et al. invention relates to a method to determine during a tracking mode a clock timing error used for synchronization purposes in a multi-carrier transmission system.

In column 4, lines 55-67, shown in FIG. 1, the multi-carrier receiver RX1 is provided with a skip and duplicate device S/D, a serial-to-parallel converter S/P, a fast Fourier transformer FFT, a rotation device ROTOR, a clock timing error determination arrangement ARR, a feedback loop FBL, a channel gain device CHANNEL and a channel analyzing device SNR.

Peeters et al. does not expressly teach the step of providing a reference channel estimate based on at least one first symbol as claimed in the application claim.

However, in column 5, lines 45-65, Peeters et al. discusses that the receiver RX1 is the ADSL type and receives at its input a multi-carrier signal following the recommendations of the already cited ADSL standard. In the symbol timing synchronization process, the receiver RX1 basically detects the boundaries of the received DMT symbols to select the correct block of consecutive samples to be fed to the fast Fourier transformer FFT. Peeters et al. further discloses that the receiver RX1 monitors the increase in difference in phase between the transmitter clock and the receiver clock to compensate for the

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difference; see column 5 line 65 via column 6 line 20. Because the receiver RX1 includes a channel analyzing device SNR as shown in figure 1 and the receiver RX1 compensates for the difference via a feedback algorithm, it would have been obvious for one of ordinary skill in the art at the time of the invention that the channel analyzing device SNR can be modified to provide a reference channel estimate based on one first symbol to be used to track the phase changes in the subsequent symbol.

In column 1, lines 55-67, Peeters et al. teaches that during a tracking mode in a multi-carrier system a clock timing error used for synchronization purposes, a phase error detection means, where to a multi-carrier signal is applied, is adapted to detect phase errors for a plurality of pilot carriers contained in a DMT symbol as shown in figure 1. In column 6, lines 30-60, the serial-to-parallel converter S/P convert a DMT symbol, including a plurality of pilot carriers, into parallel outputs, which are fed to the FFT to be converted into frequency domain.

As recited above, during a tracking mode, a phase error detection means detects phase errors for a plurality of pilot carriers contained in a DMT symbol. In column 7 lines 20-60, each phase error is multiplied with a corresponding weight coefficient to produce weighted phase error. The weighted phase errors correspond to the claimed correction factors. The weighted phase errors are used to produce a clock timing error,  $T_e$ , which is fed back via the filter FIL and digital voltage controlled oscillator (VCO) to adjust the sampling clock timing.

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Regarding claim 2, in column 7, lines 40-65, the rotation device ROTOR phase shifts each carrier of the multi-carrier signal proportional to the calculated clock timing error  $T_e$  and to frequency of the respective carrier. In view of that, the amount of phase shift corresponds to the claimed total amount of phase shift.

Regarding claim 60, claim 60 is rejected on the same ground as for claim 1 because of similar scope. The channel analyzing device SNR measures the estimate channel power. The clock timing error,  $T_e$ , corresponds to the claimed scaling factor.

Regarding claim 61, referring to figure 1, DIV and filter FIL provide the filtered clock timing error,  $T_e$ , which corresponds to the claimed scaling factor.

Regarding claim 62, claim 62 is rejected on the same ground as for claim 60 because of similar scope. Peeters et al. does not expressly show a memory for storing a reference channel estimate. However, referring to figure 1, the channel analyzing device SNR measures the estimate channel power in term of signal to noise ratio. One of ordinary skill in the art would have recognized that the channel analyzing device SNR measures and stores the estimate channel power.

Regarding claim 63, claim 63 is rejected on the same ground as for claim 61 because of similar scope.

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6. Claims 13-14, 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peeters et al. U.S. Patent 6,628,738 B1 in view of Gupta U.S. Patent 5,818,872.

Regarding claim 13, claim 13 is rejected on the same ground as for claim 1 because of similar scope. Peeters et al. does not teach providing a reference channel estimate based on at least one training symbol.

Gupta invention is directed to an apparatus and method for correcting for timing offset between a transmitter and receiver. As discussed in column 1 lines 15-30, a transmitter may send a training signal over the communications channel to the receiver for a pre-specified interval of time. The receiver may then receive the training signal, and by comparing the received training signal to the transmitted training signal, determine the spectrum for that channel and SNR spectrum. Because such training signals may be sent periodically for a better estimate of the channel spectrum and SNR spectrum as discussed in Gupta invention, it would have been obvious for one of ordinary skill in the art at the time of the invention that Peeters et al. teachings can be modified to employ such training signals periodically.

Regarding claim 14, claim 14 is rejected on the same ground as for claim 2 because of similar scope.

Regarding claim 25, claim 25 is rejected on the same ground as for claim 13 because of similar scope. Furthermore, the clock timing error,  $T_e$ , corresponds to the claimed number of clock cycles and the weighted phase errors correspond to the

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claimed first correction factors. The subsequent weighted phase errors correspond to the claimed second correction factors.

Regarding claim 26, as common knowledge of an average skill in the art, the training symbol is known and user input. Because training symbol with substantially flat phase response is much easier to estimate channel response, one of ordinary skill in the art at the time of the invention would have been motivated to utilize training symbol with substantially flat phase response.

Regarding claim 27, claim 27 is rejected on the same ground as for claim 14 because of similar scope.

### ***Allowable Subject Matter***

7. Claims 3-12, 15-24, 28-36 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. Claim 37 is allowed.

Regarding claim 37, claim 37 is allowable over cited prior art because the cited references cannot teach or suggest the claimed limitations "wherein tracking phase



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change includes determining for each pilot in the first data symbol an associated total amount of rotation relative to a corresponding pilot in the at least one training symbol, determining a least squares fit based on the associated total amount of rotation for each pilot, and generating, based on the least squares fit, the second correction factors".

9. Claim 38 is allowed.

Regarding claim 38, claim 38 is allowable over cited prior art because the cited references cannot teach or suggest the claimed limitations "wherein tracking phase change includes determining for each pilot in the first data symbol an associated total amount of rotation relative to a corresponding pilot in the at least one training symbol, determining a least squares fit based on the associated total amount of rotation for each pilot, and generating, based on the least squares fit, the second correction factors, determining a slope and phase intercept based upon the least squares fit, and wherein generating, based on the least squares fit, includes generating the second correction factors based upon subcarrier numbers, the phase intercept, and the slope".

10. Claims 39-51 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claims 39 and 51, claims 39 and 51 are allowable over the prior art of record because the cited references do not teach or suggest an apparatus for maintaining an accurate channel estimate comprising "an angle-to-converter that is to

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produce a plurality of first correction factors based upon the number of clock cycles" and "a first multiplier that is to adjust the frequency domain representation based upon the first correction factors to produce a reference channel estimate".

11. Claims 52-59 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 52, claim 52 is allowable over the prior art of record because the cited references do not teach or suggest an apparatus for maintaining an accurate channel estimate comprising "determine a least squares fit based on the associated total amount of rotation for each pilot of the plurality of the pilots in the first data symbol, and is to produce a plurality of first correction factors based on the least squares fit".

### **Conclusion**

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Tran whose telephone number is 571-272-3007. The examiner can normally be reached on Monday - Friday from 08:00 AM - 05:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone

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number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KCT

*Hanh Cong Tran*

11/09/2005

Examiner KHANH TRAN